interconvertible, and the best fractions of the former show one ultra-violet maximum only.

The elegance and accuracy of Wald's work on retinal extracts makes us hesitate to suggest that the term *retinene* is inappropriate. Unfortunately, it suggests a retinal carotenoid. *Axerophthal*, following Karrer's terminology, is not very happy in this context. Perhaps *retinaldehyde* is more appropriate than retinal.

A fuller account of this work will be published elsewhere. We express our thanks to the Medical Research Council for financial assistance.

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¹ Morton, *NATURE*, 153, 69 (1944).

² Hunter and Hawkins, *NATURE*, 153, 194 (1944).

Molecular Weight of Egg Albumin

THE molecular weight of egg albumin quoted in all but the most recent literature is 35,000–36,000, a value based on the early osmotic pressure measurements of Sørensen¹, the ultracentrifuge measurements of Svedberg and Nicols², Nicols³, and Sjögren and Svedberg⁴, as well as the diffusion data of McBain⁵. More recently, however, there has been general agreement that this value is too low; the sedimentation constant and diffusion data quoted by Svedberg and Pedersen⁶, for example, as well as the osmotic pressure data summarized in Table 1, indicating a value of 43,000–46,000.

TABLE 1.

Author	Solvent used	Result
Sørensen	Water	34,000 ¹
Adair (recalculated Sørensen's data)	Ammonium sulphate	43,000 ⁷
Marrack and Hewitt	Sodium acetate and sodium chloride	43,000 ⁸
Taylor, Adair and Adair	Sodium acetate	46,000 ⁹
Bull	Sodium acetate	45,160 ¹⁰

I have had occasion, while rehearsing the procedure to be applied to certain other proteins, to make osmotic pressure measurements with solutions of egg albumin. This protein was prepared by Prof. R. K. Cannan using the method of Kekwick and Cannan¹¹, and the amount in solution was estimated by the micro-Kjeldahl procedure and nitrogen figures of Chibnall *et al.*¹². McIlwain's phosphate-citric acid buffer at pH 4.65 was used as solvent.

The osmometer used was of the type described by Adair¹³, but the collodion membranes contained about 3 c.c. instead of 20 c.c. of protein solution. Pressures

TABLE 2.

C _g	Pressure	Molecular weight
1.00	3.92	43,400
1.86	6.71	47,200
4.00	14.4	47,300
4.23	16.7	43,100
5.84	21.1	47,200
5.95	22.0	46,000
6.26	22.2	48,100
6.88	26.1	44,900
8.30	30.6	46,200
8.84	32.5	46,300
Average		45,970

were calculated from the height of the column of solution of known density, corrected for the rise due to capillarity.

The computed values for the molecular weight are given in Table 2, where the pressures are recorded in millimetres of mercury at 0° C. It was found that over the range investigated the osmotic pressure was directly proportional to the protein concentration C_v , expressed in gm. per 100 c.c. solvent. The calculated results for the molecular weight, which are in agreement with those recorded in Table 1, though obtained under different conditions, show that the value is almost certainly $45,000 \pm 2,000$.

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¹ Sørensen, *C. R. Trav. Lab. Carlsberg*, 12, 122 (1917).

² Svedberg and Nicols, *J. Amer. Chem. Soc.*, 48, 3081 (1926).

³ Nicols, *J. Amer. Chem. Soc.*, 52, 5176 (1930).

⁴ Sjögren and Svedberg, *J. Amer. Chem. Soc.*, 52, 5187 (1930).

⁵ McBain, Dawson and Barker, *J. Amer. Chem. Soc.*, 51, 1021 (1934).

⁶ Svedberg and Pedersen, "The Ultracentrifuge" (Oxford University Press, 1940), 382.

⁷ Adair, *J. Amer. Chem. Soc.*, 49, 2524 (1927).

⁸ Marrack and Hewitt, *Biochem. J.*, 23, 1079 (1929).

⁹ Taylor, Adair and Adair, *J. Hygiene*, 32, 340 (1932).

¹⁰ Bull, *J. Biol. Chem.*, 137, 143 (1941).

¹¹ Kekwick and Cannan, *Biochem. J.*, 30, 232 (1936).

¹² Chibnall, Rees and Williams, *Biochem. J.*, 37, 354 (1943).

¹³ Adair, *Proc. Roy. Soc., A*, 108, 627 (1925).

Number of Configurations of Molecules occupying Several Sites

IN a recent communication¹, I gave a formula for $g(N_i)$ the total number of configurations of a mixture of molecules of several types, N_i denoting the number of type i . I have meanwhile obtained the more general formula for $g(N_i, X_{ij})$, the number of configurations of the molecules in which the number of pairs of sites occupied in alternate ways is specified.

Let the number of sites which are neighbours of one site be z ; let each molecule of type i occupy r_i sites; let the number of sites which are neighbours of a molecule of type i be $q_i z$. The r_i 's and q_i 's are related by $z(r_i - q_i) = 2(r_i - 1)$. Let the number of alternative configurations of a molecule of type i be p_i when a site has been chosen for one of its elements. Let the number of pairs of neighbouring sites, one occupied by a molecule of type i the other by a molecule of different type j , be denoted by zX_{ij} .

The number $g(N_i, X_{ij})$ of distinguishable configurations of given N_i and X_{ij} is given by

$$\log g(N_i, X_{ij}) = \sum_i N_i \log p_i - \sum_i \log N_i! \\ + z \sum_i \log (q_i N_i)! - (\frac{1}{2} z - 1) \log (\sum_i r_i N_i)! \\ - \frac{1}{2} z \sum_i \log (q_i N_i - \sum_j' r_j X_{ij})! - z \sum_{ij}' \log X_{ij}!$$

where $\sum'$ denotes summation over all types except i . This includes as special case a formula due to Chang² for a mixture of two types of molecule, of which one type occupies two sites, the other a single site.

The above formula can be used to derive the thermodynamic properties of mixtures with non-zero energies of mixing, whereas my previous formula was sufficient for mixtures with zero energies of mixing. In particular, I find that T_c , the temperature of critical mixing of a binary mixture of molecules A and B , is related to w , the intermolecular energy per pair of sites one occupied by part of an A the other by part of a B molecule, by the formula

$$e^{2w/kT_c} = \frac{1}{2} \{1 + ab + \sqrt{(a^2 - 1)(b^2 - 1)}\},$$

where $a = zq_A/(zq_A - 2)$ and $b = zq_B/(zq_B - 2)$.